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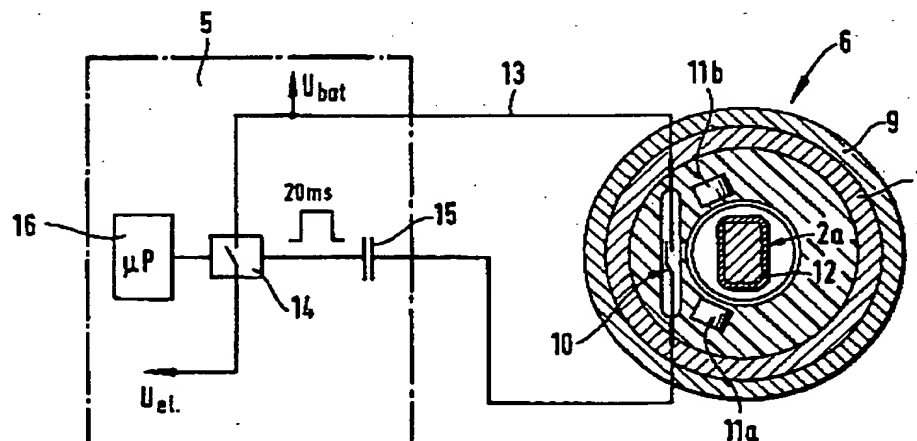
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(54) Current switch arrangement for an electromechanical locking unit

(57) A current switch arrangement for an electromechanical locking unit, which locking unit includes a cylinder lock mechanism (1) operated mechanically by a key (2), blocking means (4) functionally dependent on an electronic code associated with the key (2), and an electronic control unit (5) which, on the basis of said electronic code, is arranged to control the blocking means (4) and which, under the control of the current switch arrangement, is connectable to an electric power source (17). The arrangement comprises permanent magnet means (11a, 11b) to be attached in association

with the cylinder lock (1), a so called reed switch (10) or the like located in the immediate vicinity of the permanent magnet means (11a, 11b) within the magnetic field provided thereby and a piece (12) of ferromagnetic material located in the key shank (2a) and arranged to be positioned in the vicinity of the permanent magnet means (11a, 11b) when the key (2) is inserted into the cylinder lock (1) so that it causes a change in the magnetic field activating the reed switch (10) or the like to provide a control pulse which connects the electronic control unit (5) to the power source (17).

**Fig. 2****EP 0 818 596 A2****Best Available Copy**

Description

This invention relates to an electromechanical locking unit in accordance with the preamble of claim 1, to a switch arrangement therefor and to a lock system.

For the power source of an electromechanical locking unit it is possible to use either the mains supply or a battery or other separate power source suitable for the purpose, for instance an accumulator, which can be located a distance away from the actual locking site. The use of mains power or a power source located at a distance away from the locking site requires the provision of wiring. In this case a battery can, naturally, be used as an extra power source in the event of a power failure. A battery can also be used as the main power source if it is desired to use the locking unit as a separate, so-called "stand alone" unit independent of the mains supply and thus also free from any mains wiring. If it is also required for the key to be as uncomplicated as possible, the battery is located in the locking unit itself or in the vicinity of the locking unit. In order to prolong the effective operational life of a battery or an accumulator type power source or generally for safety reasons, it is advantageous to be able to switch off or disconnect the power supply to the locking unit when the latter is not in use. Different mechanical connecting arrangements are known, by means of which the insertion of the key of a lock into the lock simultaneously causes, through its movement, a power circuit to be switched on. This kind of known mechanical switch requires space and since it has moveable parts which are prone to wear is generally unsatisfactory.

An aim of the present invention is to provide a locking unit with a novel current switch arrangement, which is constructionally simple and reliable in use and from which the drawbacks of the known art mentioned above are essentially eliminated.

According to the present invention there is provided an electromechanical locking unit as claimed in the ensuing claim 1.

With such a locking unit saving of the life of the battery is achieved so that the current is switched on only when the key is inserted into the lock. The locking unit is, however, relatively simple in construction and is operationally reliable, since it does not include movable parts.

In practice the reed switch and the permanent magnet means are mutually positioned so that the reed switch normally remains in an open position in the magnetic field provided by the permanent magnet means.

In an advantageous embodiment of the invention the permanent magnet means comprises two permanent magnet elements located on different sides of the key hole and jointly providing the magnetic field required for operation of the reed switch. In addition the reed switch and the permanent magnet means may be located inside a protection element of the locking unit which protects the cylinder lock from outside, and in particular

which provides protection around the key hole ahead of the cylinder lock mechanism in the insertion direction of the key. Thus no special arrangement is required of the cylinder lock itself with its locking mechanism.

The piece of ferromagnetic material conveniently comprises a sleeve-like piece of iron or the like fastened to the key shank. Suitably the piece is located at the lower part of the key shank associated with the key bow, whereby the piece affects the magnetic field activating the reed switch when the key is inserted right down to the bottom of the key channel of the cylinder lock. In practice, the key bow can with advantage be case-like so that it also encloses the piece of ferromagnetic material of iron or the like.

Advantageously, the locking unit includes a pulse controlled switch which is arranged to be closed by the reed switch under the influence of the key for connecting the electronic control unit to the power source. Hence, only the generation of a minor, initial pulse is required to activate the connection. The locking unit may also include further means, for example a micro circuit, for opening the pulse controlled switch after finishing the operation of the locking unit. Such an arrangement preserves the life of the battery and keeps the switch arrangement constructionally as uncomplicated as possible.

In practice the advantages of the invention can best be met when the power source of the locking unit is a replaceable battery.

An embodiment of the invention will now be described, by way of example only, with particular reference to the accompanying drawings, in which:

Figure 1 is a schematic view of an embodiment of an electromechanical locking unit according to the invention;

Figure 2 is a schematic partly sectioned view of the locking unit shown in Figure 1; and

Figure 3 is a schematic view of the locking unit with a key shown fully inserted so as to connect the locking unit to a power source.

The drawings show a cylinder lock 1 of a locking unit which is operated in a known manner by the shank 2a of a key 2. In the arrangement shown the cylinder lock 1 cooperates with a lock housing 3 mounted in a door or the like for moving a lock bolt 3a.

The locking unit also includes electrically operated blocking means 4 controlled by an electronic unit 5 and which functions independently of the locking mechanism of the cylinder lock 1. The blocking means 4 has a locked position which prevents force being transmitted from the key 2, via the cylinder lock 1, to the lock bolt 3a, and a releasing position. The operation of the blocking means 4 is dependent on an electronic code of the key which code is memorized in a memory circuit 2b lo-

cated in the key, in practice more specifically in the key bow. In operation the key 2 is inserted into the lock 1 and a current switch means 6 connects circuits in the electronic unit 5 to a battery 17. The electronic code associated with the key is supplied to the unit 5 and/or is read in a known manner such as, for instance, through induction. In the embodiment shown antenna means 7 are used to read the code sent from the key. If the correct code is read, the electronic unit 5 causes the blocking means 4 to be moved into its releasing position, which allows the lock bolt 3a to be removed by operation of the key 2. The locking unit may also be provided, in a known manner, with a protective fitting 8 for protecting the lock parts 1, 4, 6 and 7 against attempted forcing from outside.

The battery 17 may, for instance, be located in the electronic unit 5 itself or in the immediate vicinity of the electronic unit. To prolong the effective life or operation time of the battery 17, the current switch means 6 provides current to the electronic unit 5 only when the key 2 is inserted into the lock 1. In the embodiment shown in Figures 2 and 3 the current switch means 6 comprises a so called reed switch 10 and two permanent magnets 11a and 11b. The reed switch 10 is located in the magnetic field provided by the magnets and is in a normally open condition. When the key 2 is inserted into the lock, as shown in Figures 2 and 3, a piece 12 of ferromagnetic material, e.g. a sleeve of ferromagnetic material located on the shank of the key 2, causes a change in the magnetic field. As a consequence of this change in the magnetic field, the reed switch 10 provides a control voltage pulse U_{bat} in a circuit 13, which closes a pulse-controlled switch 14 under the influence of a capacitor 15 included in the circuit 13. In this way the electronic unit 5 is connected to the battery 17. On withdrawing the key 2 from the key hole, a micro circuit 16 included in the electronic unit 5 opens the switch 14 to save battery life.

The reed switch 10 and the permanent magnets 11a and 11b are with advantage arranged in a separate switch unit 9 located inside the protection fitting 8. In principle, and depending on the locking mechanism of the cylinder lock, the switch means could also be located inside the cylinder lock, in which case the piece 12 of ferromagnetic material would be located correspondingly closer to the free end of the key shank 2a. However such an arrangement would be more difficult to manufacture. Also, the number of permanent magnets provided can be varied. It is only necessary that the reed switch remains open when the key is not in the lock and is closed when the key is inserted into the lock to influence the magnetic field created by the permanent magnets. The piece 12 of ferromagnetic material is with advantage designed so that on the one hand it provides a change in the magnetic field, detected by the reed switch 10, when the key is inserted into the lock and on the other hand can easily be supported and fastened to the key.

The invention is not limited to the embodiment

shown but several modifications thereof are feasible, including variations which have features equivalent to, but not literally within the meaning of, features in any of the ensuing claims.

Claims

1. An electromechanical locking unit including a key (2) having a key shank (2a), a cylinder lock mechanism (1) operated mechanically by the key (2), blocking means (4), an electronic control unit (5) which is arranged to control said blocking means (4) in dependence on an electronic code associated with the key (2), an electric power source (17), and a current switch arrangement for controlling the connection of the electronic control unit (5) to the electric power source (17), characterised in that the current switch arrangement comprises permanent magnet means providing a magnetic field (11a, 11b) to a reed switch (10) or the like located in the immediate vicinity of said permanent magnet means (11a, 11b) within the magnetic field provided thereby and a piece (12) of ferromagnetic material located in the key shank (2a), the position of the permanent magnetic means (11a, 11b) and the position of said piece (12) in the key shank (2a) being such that when the key (2) is inserted into the cylinder lock mechanism (1) the said piece (12) causes a change in the said magnetic field and activates the reed switch (10) or the like to generate a control pulse for connecting the electronic control unit (5) to the power source (17).
2. A locking unit according to claim 1, characterised in that the reed switch (10) and the permanent magnet means (11a, 11b) are mutually positioned so that the reed switch (10) normally remains in an open condition in the magnetic field provided by the permanent magnet means (11a, 11b) when not influenced by said piece (12) of ferromagnetic material.
3. A locking unit according to claim 1 or 2, characterised in that the permanent magnet means (11a, 11b) comprises two permanent magnet elements (11a, 11b) located on different sides of the key hole of the locking unit and together providing the magnetic field for operation of the reed switch (10).
4. A locking unit according to any one of the preceding claims, characterised in that the locking unit further includes a protection element (8) within which the reed switch (10) and the permanent magnet means (11a, 11b) are located, the protection element (8) protecting the cylinder lock mechanism (1) from outside and being positioned around the key hole ahead of the cylinder lock mechanism (1) in the insertion direction of the key (2).

5. A locking unit according to any one of the preceding claims, characterised in that the piece (12) of ferromagnetic material comprises a sleeve-like device of iron or the like fastened to the key shank (2a) and located on the key shank (2a) at a part thereof associated with the key bow remote from the free end of the key shank. 5
6. A locking unit according to any one of the preceding claims, characterised in that the current switch arrangement includes a pulse controlled switch (14) which is arranged to be closed by the reed switch (10) under the influence of the key (2) for connecting the electronic control unit (5) to the power source (17), and means, for example a micro circuit (16), for opening said pulse controlled switch (14) on removal of the key from the cylinder lock mechanism (1). 10 15
7. A locking unit according to any one of the preceding claims, characterised in that said power source (17) comprises a replaceable battery. 20
8. A lock system comprising a cylinder lock mechanism (1), a key (2) with a key shank (2a) insertable into the lock mechanism (1) for operating a lock member (3a), blocking means (4) controllable to allow or prevent operation of the lock member on insertion of the key (2) into the lock mechanism (1), an electronic control unit (5) controlling operation of the blocking means (4) in dependence on an electronic code associated with the key (2), an electric power source (17), and switch means for controlling the connection of the electronic control unit (5) to the electric power source (17), characterised in that the switch means comprises permanent magnet means providing a magnetic field (11a, 11b) to a reed switch (10) or the like located in the immediate vicinity of said permanent magnet means (11a, 11b) within the magnetic field provided thereby and a piece (12) of ferromagnetic material arranged on the key shank (2a), the position of the permanent magnetic means (11a, 11b) and the position of said piece (12) in the key shank (2a) being such that when the key (2) is inserted into the cylinder lock mechanism (1) the said piece (12) causes a change in the said magnetic field and activates the reed switch (10) or the like to generate a control pulse for connecting the electronic control unit (5) to the power source (17). 25 30 35 40 45 50
9. A switch arrangement for an electromechanical locking unit including a cylinder lock mechanism (1) operated mechanically by a key (2), blocking means (4) controllable by an electronic control unit (5) in dependence on an electronic code associated with the key (2) to allow or prevent operation of a lock member (3a) and an electric power source (17) con-

nectible to the electronic control unit (5), characterised in that the switch arrangement comprises a key (2) for operating the lock mechanism (1) having a key shank (2a) and switch means comprising permanent magnet means providing a magnetic field (11a, 11b) to a reed switch (10) or the like located in the immediate vicinity of said permanent magnet means (11a, 11b) within the magnetic field provided thereby and a piece (12) of ferromagnetic material located in the key shank (2a), the position of the permanent magnetic means (11a, 11b) and the position of said piece (12) in the key shank (2a) being such that when the key (2) is inserted into the cylinder lock mechanism (1) the said piece (12) causes a change in the said magnetic field and activates the reed switch (10) or the like to generate a control pulse for connecting the electronic control unit (5) to the power source (17).

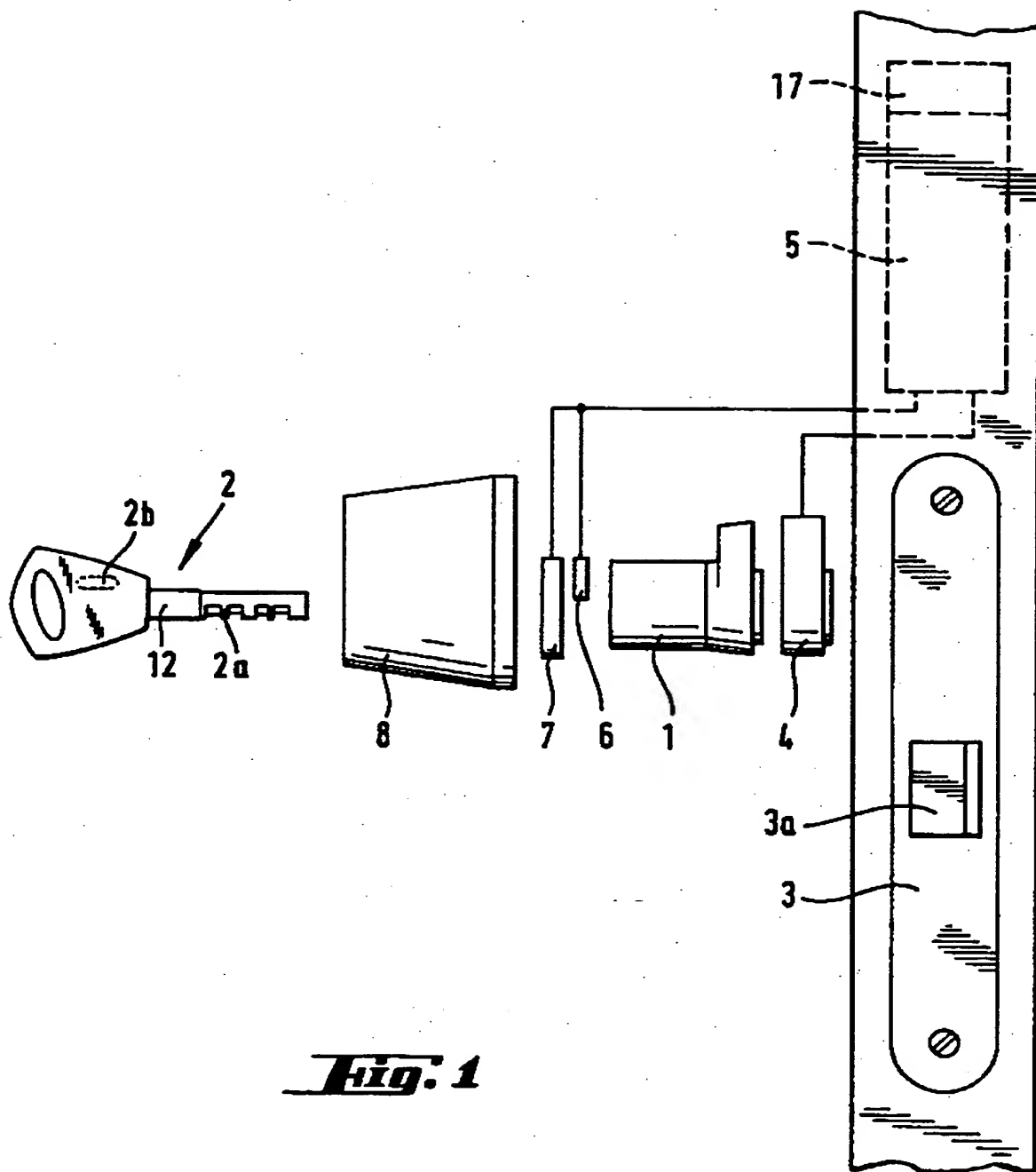


Fig. 1

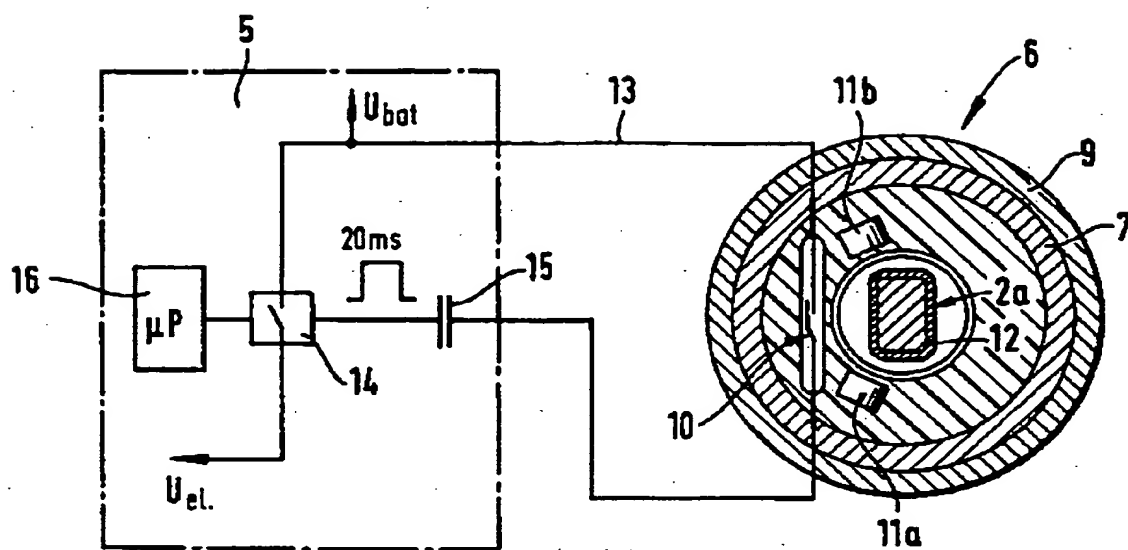


Fig. 2

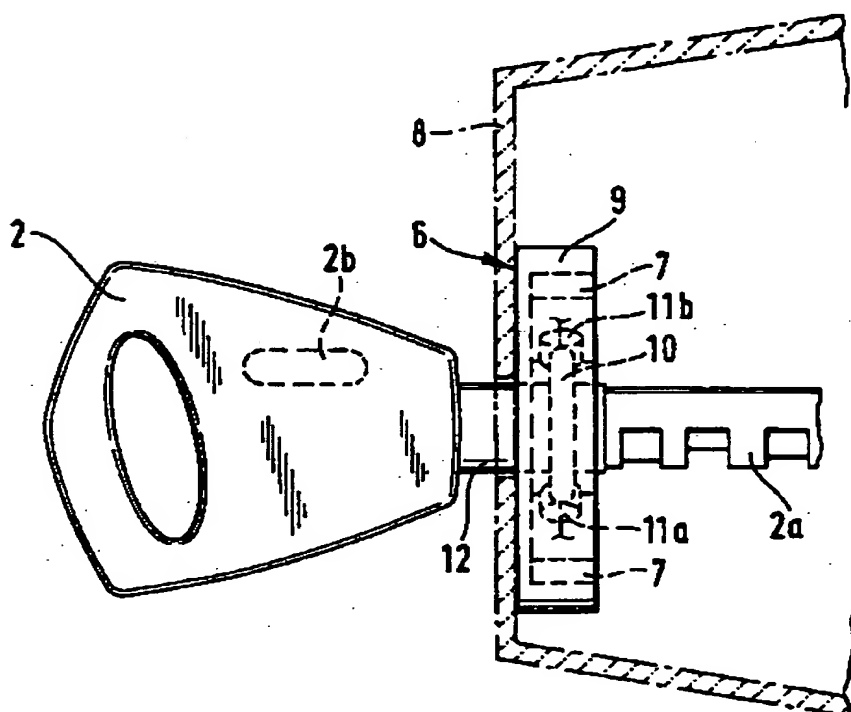


Fig. 3

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